THE AMERICAN MATHEMATICAL MONTHLY.

Entered at the Post-office at Springfield, Missouri, as Second-class Mail Matter.

VOL. V. AUGUST-SEPTEMBER, 1898. No. 8-9.

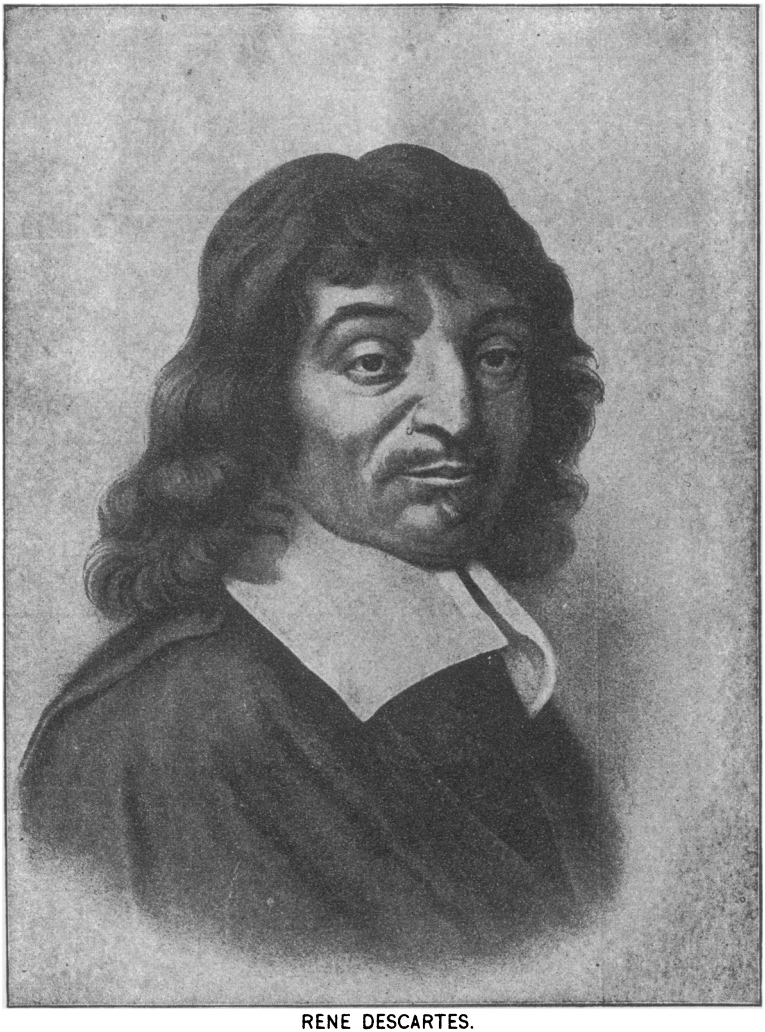
BIOGRAPHY.

RENÉ DESCARTES.

BY B. F. FINKEL.

RENÉ DESCARTES, the first of the modern school of mathematicians, was born at La Haye, a small town on the right bank of the Creuse and about midway between Tours and Poitiers, on March 31st, 1596, and died at Stockholm, on February 11th, 1650. "The house is still shown where he was born, and a *métairie* about three miles off still retains the name of Les Cartes. His family on both sides was of Poitevin descent and had its head-quarters in the neighboring town of Châtterault, where his grandfather had been a physician. His father, Joachim Descartes, purchased a commission as counsellor in the Parlement Rennes and thus introduced the family into that demi-noblesse of the robe of which, in stately isolation between the bourgeoisie and the high nobility, maintained a lofty rank in the hierarchy of France. For one-half of each year required for residence the elder Descartes removed, with his wife, Jeanne Brochard, to Rennes. Three children, all of whom first saw the light at La Haye, sprang from the union,—a son, who afterwards succeeded to his father in the Parlement, a daughter who married a M. du Crevis, and a second son, René. His mother, who had been ailing beforehand, never recovered from her third confinement; and the motherless infant was intrusted to a nurse, whose care Descartes in after years remembered by a small pension."*

Britannica Encyclopedia, Ninth Edition.



RENE DESCARTES.

By courtesy of The Open Court.

Descartes, who early showed an inquisitive mind, was called by his father, "my philosopher." At the age of eight, Descartes was sent to the school of La Flèche, which Henry IV had lately founded and endowed for the Jesuits, and here he continued from 1604 to 1612. Of the education here given, of the equality maintained among the pupils, and of their free intercourse, he spoke at a later period in terms of high praise. Descartes himself enjoyed exceptional privileges. His feeble health excused him from the morning duties, and thus early he acquired the habit of matutinal reflection in bed, which clung to him throughout life. When he visited Pascal in 1647, he told him that the only way to do good work in mathematics and to preserve his health was never to allow any one to make him get up in the morning before he felt inclined to do so. Even at this period he had begun to distrust the authority of tradition and his teachers.

Two years before leaving school (1610) he was selected as one of twenty-four gentlemen who went forth to receive the heart of the murdered king as it was borne to its resting place at La Flèche. During the winter of 1612, he completed his preparations for the world by lessons in horsemanship and fencing; and then in the spring of 1613 he started for Paris to be introduced to the world of fashion. Fortunately the spirit of dissipation did not carry him very far, the worst being a passion for gaming. Here through the medium of the Jesuits he made the acquaintance of Mydorge, one of the foremost mathematicians of France, and renewed his schoolboy friendship with Father Mersenne, and together with them he devoted the two years of 1615 and 1616 to the study of mathematics.

"The withdrawal of Mersenne in 1614 to a post in the provinces was the signal for Descartes to abandon social life and shut himself up for nearly two years in a secluded house of the Faubourg St. Germain. Accident, however, betrayed the secret of his retirement; he was compelled to leave his mathematical investigations and to take a part in entertainments, where the only thing that chimed in with his theorizing reveries was the music. The scenes of horror and intrigue which marked the struggle for supremacy between the various leaders who aimed at guiding the politics of France made France no fit place for a student and held out little honorable prospect for a soldier. Accordingly, in May, 1617, Descartes, now twenty-one years of age, set out for the Netherlands, and took service in the army of Prince Maurice of Orange, one of the greatest generals of the age, who had been engaged for some time in a war with the Spanish forces in Belgium. At Breda, he enlisted as a volunteer, and the first and only pay which he accepted he kept as a curiosity through life. There was a lull in the war; and the Netherlands were distracted by the quarrels of Gomarists and Arminians. During the leisure thus arising, Descartes one day, as he roved through Breda, had his attention drawn to a placard in the Dutch tongue; and as the language of which he never became perfectly master, was then strange to him, he asked a bystander to interpret it in either French or Latin. The stranger, who happened to be Isaac Beeckman, principal of the College of Dort, offered with some surprise to do so into Latin, if the inquirer would bring him a so-

lution of the problem,—for the advertisement was one of those challenges which the mathematicians of the age, in the spirit of the tournament of chivalry, were accustomed to throw down to all comers, daring them to discover a geometrical mystery known as they fancied to themselves alone. Descartes promised and fulfilled; and a friendship grew up between him and Beeckman—broken only by the literary dishonesty of the latter, who in later years took credit for the novelty contained in a small essay on music (Compendium Musicae) which Descartes wrote at this period and intrusted to Beeckman."*

The unexpected test of his mathematical attainments afforded by the solution of the problem referred to, its solution costing him only a few hours study, made the uncongenial army life distasteful to him, but under family influence and tradition, he remained a soldier, and was pursuaded at the commencement of the thirty years' war to volunteer under Count de Bucquoy in the army of Bavaria. The winter of 1619, spent in quarters at Neuburg on the Danube, was the critical period in his life. Here, in his warm room (*dans un poele*), he indulged those meditations which afterwards led to the *Discours de la Méthode* (Discourse of Method). It was here that, on the eve of St. Martin's day, November 10, 1619, he "was filled with enthusiasm, and discovered the foundations of a marvelous science."

He retired to rest with anxious thoughts of his future career, which haunted him through the night in three dreams, that left deep impressions on his mind. "Next day," he says, "I began to understand the first principles of my marvelous discovery." Thus the date of his philosophical conversion is fixed to a day. This day marks the birth of modern mathematics. His discovery, viz., the coöperation of ancient geometry and algebra, is epoch-making in the history of mathematics.

It is frequently stated that Descartes was the first to apply algebra to geometry. This statement is not true, for Vieta and others had done this before him, and even the Arabs sometimes used algebra in connection with geometry. "The new step that Descartes did take was the introduction into geometry of an analytical method based on the notion of variables and consonants, which enabled him to represent curves by algebraic equations. In the Greek geometry, the idea of motion was wanting, but with Descartes it became a very fruitful conception. By him a point was determined in position by its distances from two fixed lines or axes. These distances varied with every change of position in the point. This geometric idea of *co-ordinate representation* together with the algebraic idea of *two variables in one equation* having an indefinite number of simultaneous values, furnished a method for the study of loci, which is admirable for the generality of its solutions. Thus the entire conic sections of Appollonius is wrapped up and contained in a single equation of the second degree."†

"Descartes found in mathematics, as did Kant and Comte, the type of all faultless thought; and he proved his appreciation of his insight by the invention

Encyclopedia Britannica, Ninth Edition.
†*Cajori's History of Mathematics.*

of a new symbolic mechanism and artifice for the applications of algebra to geometry (*Analytic Geometry*, as it is now called, which, in a growing sense, let it be said, existed before him), and by his discoveries in the theory of equations, which were fundamental in their importance."*

After a short sojourn in Paris, Descartes moved to Holland, then at the height of its power. There for twenty years he lived, giving up all his time to philosophy and mathematics. Science, he says, may be compared to a tree; metaphysics is the root, physics is the trunk, and the three chief branches are mechanics, medicine, and morals, these forming the three applications of our knowledge, namely, to the external world, to the human body, and to the conduct of life; and with these subjects alone his writings are concerned.

He spent the time from 1629 to 1633 writing *Le Monde*, a work embodying an attempt to give a physical theory of the universe; but finding its publication likely to bring on him the hostility of the Church, and having no desire to pose as a martyr, he abandoned it. The incomplete manuscript was published in 1664.

He then devoted himself to composing a treatise on universal science; this was published at Leyden in 1637 under the title Discourse de la méthode pour bien conduire sa raison et chercher la verité dans les sciences, and was accompanied with three appendices entitled La Dioptrique, Les Méléores, and La Géométrie. It is from the last of these that the invention of analytical geometry dates. In 1641, he published a work called Meditations, in which he explained at some length his views of philosophy as sketched out in the *Discourse*. In 1644, he issued the Principia Philosophiae, the greater part of which was devoted to physical science especially the laws of motion and the theory of vortices. In his theory of vortices, he commences with a discussion of motion; and then lays down ten laws of nature, of which the first two are almost identical with the first two as laid down by Newton. The remaining eight are inaccurate. He next proceeds to a discussion of the nature of matter which he regards uniform in kind though there are three forms of it. He assumes that the matter of the universe is in motion, that this motion is constant in amount, and that the motion results in a number of vortices. He states that the sun is the center of an immense whirlpool of this matter, in which the planets float and are swept round like straws in a whirlpool of water.

Each planet is supposed to be the center of a secondary whirlpool by which its satellites are carried, and so on. All of these assumptions are arbitrary and unsupported by any investigation. It is a little strange that a man who began his philosophical reasonings by doubting all things and finally coming to *cogito, ergo sum* should have made assumptions so groundless.

While Descartes was a philosopher of a very high type, yet his fame will ever rest on his researches in mathematics. The first important problem solved by Decartes in his geometry is the problem of Pappus, viz.: "Given several straight lines in a plane, to find the locus of a point such that perpendiculars, or,

*The Open Court, August, 1898.

more generally, straight lines at given angles, drawn from the point to the given lines, shall satisfy that the product of certain of them shall be in given ratio to the product of the rest." "The most important case of this problem is to find the locus of a point such that the product of the perpendiculars on m given lines be in a constant ratio to the product of the perpendiculars on n other given straight lines. The ancients had solved this geometrically for the case $m=1$, $n=1$, and the case $m=1$, $n=2$. Pappus had further stated that if $m=n=2$, the locus was a conic, but he gave no proof; Descartes also failed to prove this by pure geometry, but he showed that the curve was represented by an equation of the second degree, that is, was a conic; subsequently Newton gave an elegant solution of the problem by pure geometry."*

In algebra, Descartes expounded and illustrated the general methods of solving equations up to those of the fourth degree (and believed that his method could go beyond), stated the law which connects the positive and negative roots of an equation with the change of signs in the consecutive terms, known as Descartes' Law of Signs, and introduced the method of indeterminate coefficients for the solution of equations.

In appearance, Descartes was a small man with large head, projecting brow, prominent nose, and black hair coming down to his eyebrows. His voice was feeble. Considering the range of his studies he was by no means widely read, had no use for Greek, as is shown by his disgust when he found that Queen Christina devoted some time each day to its study, and despised both learning and art unless something tangible could be extracted therefrom. In philosophy, he did not read much of the writings of others. In disposition, he was cold and selfish, He never married, and left no descendants, though he had one illegitimate daughter, Francine, who died in 1640, at the age of five.

In 1649, through the instigation of his close personal friend, Chanut, he received an invitation to the Swedish court, and in September of that year he left Egmond for the north. Here, on the 11th of February, 1650, he died of inflamation of the lungs brought about by too close devotion to the sick-room of his friend Chanut, who was dangerously ill with the same disease.

*Ball's *Short Account of the History of Mathematics.*